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CLAIMS

1. An optical device for providing optical amplification comprising
   - a substrate, and
   - a photo-definable polymer structure formed on the substrate in a shape defined by a number of sidewalls, n, and being doped with an optically active medium,

wherein the sidewalls of the structure form a cavity resonator so that an electromagnetic wave upon pumping of the device is emitted laterally.

2. An optical device for providing optical amplification comprising
   - a substrate, and
   - a photo-definable polymer structure provided on the substrate in a shape defined by a number of sidewalls, n, and being doped with an optically active medium,

wherein the shape and/or at least one material provided at least along a part of at least one sidewall of the structure are selected so that an electromagnetic wave propagating in the structure will experience total internal reflection when incident on no more than n-1 sidewalls.

3. An optical device according to claims 1 or 2, wherein the electromagnetic wave propagating in the structure is incident at the no more than n-1 sidewalls at an angle greater than a critical angle.

4. An optical device according to any of claims 1-3, wherein total internal reflection is obtained by providing the first material along a first number of sidewalls and providing a second material along a second number of sidewalls, the first and second materials and the angles between the sidewalls being selected so as to provide total internal reflection due to an incident angle of a propagating electromagnetic wave being greater than the critical angle for a propagating electromagnetic wave incident on the first number of sidewalls, whereas the second material is selected so that the propagating electromagnetic wave incident on the second number of sidewalls are incident under an angle being less than the critical angle, so as to allow for outputting an electromagnetic wave from the second number of sidewalls.

5. An optical device according to any of claims 1-4, wherein a second material is provided along at least a part of at least one sidewall for allowing for emission of an electromagnetic wave from the structure, wherein the shape is rectangular, and wherein the critical angle of the at least part of the at least one sidewall is altered due to the presence of the at second material.

6. An optical device according to any of claims 1-5, wherein the emitted or the propagating electromagnetic wave is a single mode electromagnetic wave.

7. An optical device according to any of claims 2-6, wherein the sidewalls of the structure form a cavity resonator.

8. An optical device according to claim 1 or 7, wherein the length of the cavity resonator is on the order of the wavelength of the emitted or the propagating electromagnetic wave.

9. An optical device according to any of claims 1, 7 or 8, wherein the wavelength of the emitted electromagnetic wave is determined as a function of concentration of optically active medium in the polymer and resonator cavity length.

10. An optical device according to any of claims 1-9, wherein the photo-definable polymer is definable by photo lithography.

11. An optical device according to any of claims 1-10, wherein the device comprises an array of cavity resonators.

12. An optical device according to claim 11, wherein at least two cavity resonators in the array are coupled.

13. An optical device according to any of claims 1-12, wherein the shape is circular or elliptical.

14. An optical device according to any of claims 1-13, wherein the photo-definable polymer is a negative tone resist.

15. An optical device according to any of claims 1-13, wherein the photo-definable polymer is epoxy based.

16. An optical device according to any of claims 1-15, wherein the polymer is photo-definable by an electromagnetic source having a wavelength above 250 nm.

17. An optical device according to any of claims 1-16, wherein the polymer is photo-definable by an electromagnetic source having a wavelength of about 370 nm (i-line)

18. An optical device according to any of claims 1-17, wherein the optically active medium comprises organic compounds, rare earths, such as Erbium, nanoparticles, or quatum dots.

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19. An optical device according to any of claims 1-17, wherein the optically active medium is a dye with a concentration in the polymer above 1,1 μmole/cm^3.

20. An optical device according to any of claims 1-19, wherein the substrate is a metal substrate, a semiconductor substrate, a ceramic substrate, a glass substrate, such as a Pyrex substrate or any combination of such materials.

21. An optical device according to any of claims 1-20, wherein the structure has a height above 2 μm.

22. An optical device for providing optical amplification, the device comprises

- a substrate,
- a photo-definable polymer structure formed on the substrate in a shape defining a cavity resonator and being doped with an optically active medium.

23. An optical device according to any of claims 1-22, wherein the photo-definable polymer is SU-8.

24. A method of manufacturing an optically active medium, the method comprising the steps of:

- providing a substrate,
- providing a photo-definable polymer being doped with an optically active medium on the substrate,
- defining a shape of a cavity resonator in the photo-definable polymer by photolithography.

25. A method according to claim 24, wherein the step of providing the photo-definable polymer on the substrate comprises the step of spin-coating the substrate with the photo-definable polymer being doped with an optically active medium.

26. A method according to claim 25, wherein the step of defining the structure comprises the steps of

- exposing the spin-coated polymer in a predetermined pattern, and
- developing the predetermined pattern to form at least one polymer structure.

27. A method according to claim 26, wherein the step of defining the structure further comprises the step of soft-baking the polymer prior to the exposing step.

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28. A method according to claims 26 or 27, wherein the step of defining the structure further comprises the step of post exposure baking the polymer after the exposing step.

29. A method according any of claims 26-28, wherein the step of developing comprises the step of using a wet developer for developing the pattern.

30. A method for laterally emitting an electromagnetic wave, the method comprises the steps of

- providing a photo-definable polymer being doped with an optically active medium on a substrate,
- defining a shape of a cavity resonator in the polymer by exposing the polymer to optical radiation,
- developing the exposed polymer to obtain at least one structure in the polymer,
- pumping the structure by a pump source so as to provide activation of the optically active medium,
- laterally emitting an electromagnetic wave.

31. A micro system comprising at least one optical device according to any of claims 1-23.

32. A micro system according to claim 31, further comprising at least one waveguide channel.

33. A micro system according to claim 31 or 32, wherein the at least one waveguide channel and the polymer structure of the optical device is fabricated in the same polymer material.

34. A micro system according to any of claims 31-33, wherein the polymer structure is provided so that an output of the polymer structure is coupled directly into the polymer waveguide channel.